

## Models and Applications of the UEDGE Code<sup>†</sup>

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The UEDGE code simulates two-dimensional (2-D) transport in a tokamak scrape-off layer (SOL). Symmetry is assumed in the toroidal direction. Fluid equations for particle, momentum and energy balance describe both plasma and neutral species. Plasma species include hydrogenic ions, electrons and multiple charge states of impurities. Transport parallel to the local magnetic field is classical, and perpendicular transport is characterized by a few anomalous (radial) transport coefficients. Plasma currents, the electrostatic potential, classical drifts and impurity radiation losses are included in the model. The spatial domain is a multiply-connected region in the poloidal plane that includes parts of the core, SOL and private flux regions. The code includes a grid generator that produces a non-orthogonal mesh with one set of coordinate surfaces parallel to magnetic flux surfaces. A 2-D nine-point finite-difference stencil permits accurate modeling of complicated divertor geometries. Fully implicit procedures are used for solving the steady-state and time-dependent forms of the fluid equations. The importance of these model features will be illustrated by simulation results for various divertor configurations and plasma regimes.

The UEDGE code has been used to simulate existing and proposed experiments, including DIII-D, Alcator C-Mod, TCV, JET, TPX and ITER. The simulation results have been extensively benchmarked against DIII-D data to obtain estimates of anomalous radial transport parameters in the model. Some examples will be shown to illustrate this important aspect of the modeling. The role of tilted divertor plates and radial transport for controlling the distribution of impurities and radiation losses in the SOL will be demonstrated in simulations of the ITER radiative divertor.

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